User's Manual

DAQMaster MW100
Ethernet/IP Instruction Manual

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IM MW100EIP
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Introduction

There is a large install base of industrial automation Programmable Logic Controllers (PLCs) and remote I/O that support Ethernet/IP (EIP) also known as Control and Information Protocol (CIP) over Ethernet. Most notable is the family of PLCs and I/O manufactured by Allen-Bradley® (AB) consisting of: PLC 2®, PLC 5®, SLC 500®, MicroLogix®, CompactLogix® and ControlLogix®. Yokogawa's DAQMaster® MW100 is a multi-protocol data acquisition, recording and reporting device that now has optional support for communications to EIP devices. It is now possible for the MW100 to record data directly from EIP device inputs and registers over an Ethernet network. The MW100 may also act as remote I/O for EIP PLCs and Human Machine Interfaces (HMIs).

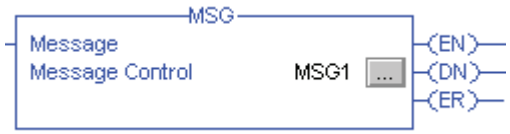
When using EIP, the MW100 is a passive device on the Ethernet network in that it does not initiate read or write requests. In most cases the MW100 will be working in conjunction with a PLC or controller. Read and write requests via EIP are initiated through program logic in controllers via Explicit Messaging and I/O Messaging (also known as Implicit Messaging). With the controller managing communications, it is possible to integrate messaging such that communications only occurs when dictated by the control logic. Management of communications by the controller allows the controller to decide when it is appropriate to write a value to the MW100 (e.g., when a computation is complete).

The MW100 also supports older controllers where EIP was not a standard option. For older controllers that support Programmable Controller Communication Commands (PCCC) also known as DF1 communications via serial ports, an inexpensive gateway can be used to convert communications to EIP. For controllers that support PCCC encapsulated via Ethernet, the MW100 supports EIP with embedded PCCC read and write requests.

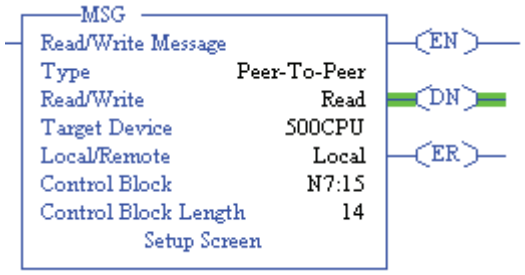
For example purposes RSLogix 5000®, RSLogix 500®, CompactLogix® and SLC 504® are used as examples of EIP configuration software and hardware; however, any EIP software and hardware should work in a similar manner as long as they support Explicit and I/O (Implicit) messaging.

Explicit Messaging

Explicit Messaging is a point to point, request/response messaging protocol for unscheduled information transfer. In ladder logic programming explicit messaging is usually denoted by a messaging command that is all inclusive (what is going to be read or written and to what register in what device).



Example Message Command from RSLogix 5000® as used with CompactLogix® PLC



Example Message Command from RSLogix 500® as used with SLC 500® PLC

The tables below detail the naming convention to use when creating explicit messages within RSLogix®. In the left most column is the native MW100 register starting with I/O channels 001 through 060, Computation Channels A001 through A300 (also known as Math Channels) and finally Communication Channels C001 through C300. I/O Channels and Computation Channels are considered read only while Communication Channels are read/write. To the right of the MW100 register are the naming conventions that are used within RSLogix® messages. In an RSLogix 500® message, N10:0 would be used to retrieve an MW100's I/O Channel 001 as a 16bit integer. In an RSLogix 5000® message, real[3299] would be used for read or write requests of an MW100's Communication Channel C300. If a message was used to read Computation Channel A060 from an MW100, RSLogix 5000® would use dint[2059] as the Source Element.

■ File number / Tag names for Explicit messaging

□ I/O Channel (001 to 060, max. 60 ch)

Ch.	PLC2	PLC5 / SLC	CIP int	CIP dint	CIP real
001	1000	N,D,F10:0	int [1000]	dint [1000]	real [1000]
:	:	:	:	:	:
060	1060	N,D,F10:60	int [1060]	dint [1060]	real [1060]

Ch.	PLC2	PLC5 / SLC	CIP int	CIP dint	CIP real
A001	2000	N,D,F20:0	int [2000]	dint [2000]	real [2000]
:	:	:	:	:	:
A300	2299	N,D,F22:99	int [2299]	dint [2299]	real [2299]

□ Communication Channel (C001 to C300, max. 300 ch)

Ch.	PLC2	PLC5 / SLC	CIP int	CIP dint	CIP real
C001	3000	N,D,F30:00	int [3000]	dint [3000]	real [3000]
:	:	:	:	:	:
C300	3299	N,D,F32:99	int [2299]	dint [3299]	real [3299]

- With N file or CIP int tag, you can access to the data as short integer (word)
- With D file or CIP dint tag, you can access to the data as long integer (double word)
- With F file or CIP real tag, you can access to the data as real (float)

When using RSLogix 5000® and RSLogix 500® there are different types of messages that correspond to the different type of PLCs. Everything from AB PLC 2® through AB ControlLogix® PLC can be communicated using the MSG block. The following covers all the MSG instructions supported by the MW100 with EIP.

MW 100 supports following MSG instructions

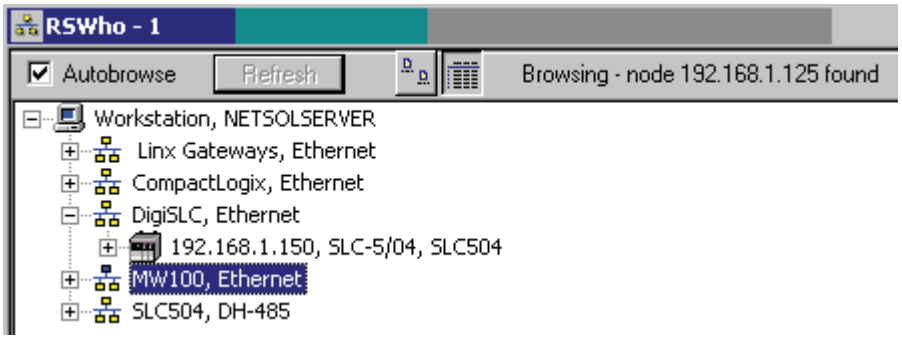
- PLC2 Unprotected Read / Write
- PLC5 Word Range Read / Write
- PLC5 Typed Read / Write
- SLC Typed Read / Write
- CIP Data Table Read / Write
- CIP Generic Read / Write

Step by step examples of explicit messaging within RSLogix 500® and RSLogix 5000® are detailed in Appendix A.

I/O Messaging (Implicit Messaging)

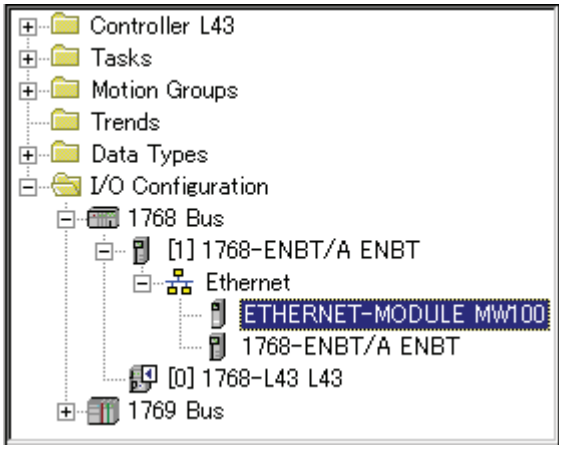
I/O Messaging, also known as Implicit Messaging, is used for point to point or multicast and to transmit application specific I/O data. Implicit messages are exchanged across I/O connections with a Connection ID (predefined path as first defined in RSLinx® and then RSLogix®). The Connection ID will define where the MW100 is located (IP Address), the Ethernet port on the PLC through which to communicate, as well as what points are considered inputs or outputs.

The following picture shows RSLinx® setup to communicate to the Ethernet device MW100 (this connection points to an MW100 on the network).



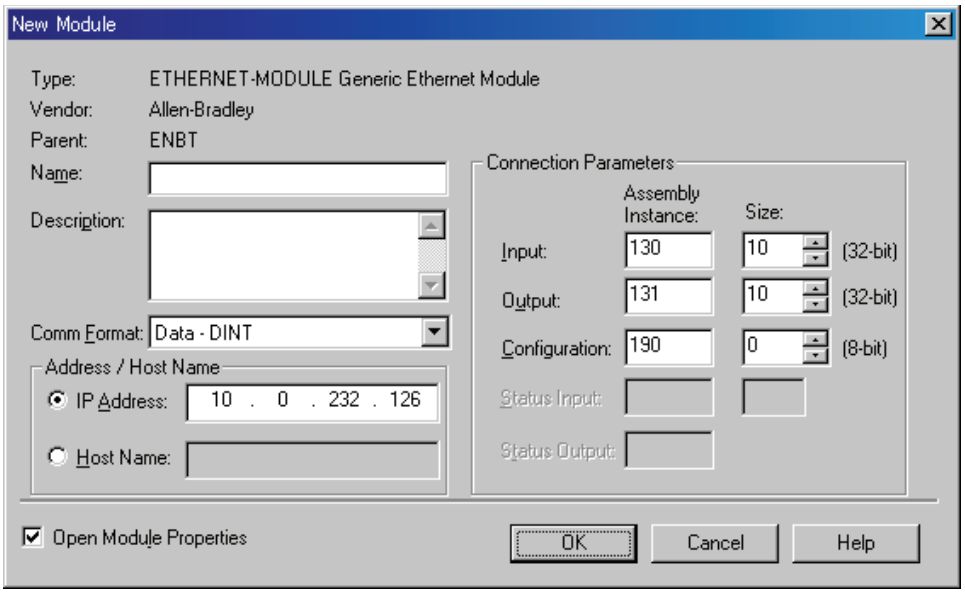
RSLinx® Configured with path named MW100

Once a device is configured inside of RSLinx®, it can be added to the RSLogix® project. In the case below, ETHERNET-MODULE MW100 points to the networked MW100.



Controller Organizer tree showing MW100 Path

By clicking on ETHERNET-MODULE MW100 within the Controller Organizer tree, the connection can be fully configured. Note - the IP Address should point to an MW100, Comm Format which defines what data types to use and Connection Parameters which layout the inputs and outputs of the MW100. In this case, the connection is configured to communicate using double precision integers to an MW100 at IP address 10.0.232.126 with inputs at Assembly Instance 130 (corresponding to Communication Channel C001-C010; 10 channels due to Size), and outputs at Assembly Instance 131 (corresponding to Communication Channel C101-C110; 10 channels due to Size). The Size of the Input and Output Assembly Instance can range from 1 to 100 to encompass 100 Communication or Computation Channels in a block and 60 for I/O Channels. When using I/O Messaging, there is a limit of 100 inputs and 100 outputs per MW100 (Explicit Messaging must be used to reach more MW100 channels). Note a limit of 125 32-bit points per instance is the maximum data size that EIP allows for I/O Messaging.



Connection and Assembly Instance Configuration in RSLogix 5000®

The following diagram depicts the available Instance IDs, Sizes and Data Types that can be configured within a connection.

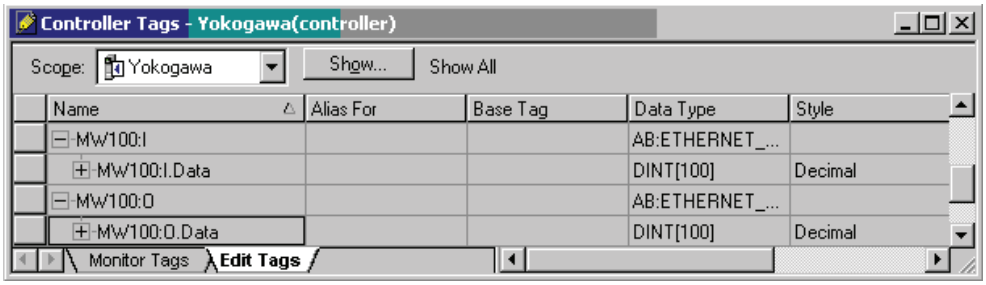
■ Assembly instances for I/O messaging

□ Channels in Assembly Object

Ch.	Kind	Instance ID	Size	Type
001 - 060	Producer	110	4 x 60	dint
A001 - A100	Producer	120	4 x 100	dint
A101 - A200		121	4 x 100	
A201 - A300		122	4 x 100	
C001 - C100	Producer / Consumer	130	4 x 100	dint
C101 - C200		131	4 x 100	
C201 - C300		132	4 x 100	
	Configuration	190	0	
	Consumer	191	0	

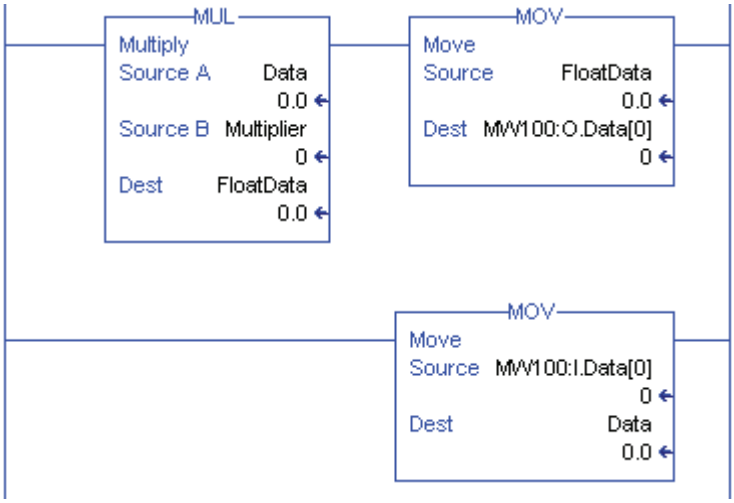
Table of MW100 Channels with corresponding Instance ID

Once an instance has been properly configured, the MW100 inputs and outputs will show up in the Controller Tags window.



MW100 Channels within RSLogix 5000® Controller Tags Screen

These points can now be assigned as inputs and outputs as well as monitored (when online) within programs as shown in the example below. Note that the tags can be used within any logic element (not just MSG blocks as with Explicit Messaging). In this case the logic is reading from the first input instance corresponding to Communication Channel C001 and writing to the output instance corresponding to Communication Channel C101.



Sample Logic using I/O Messaging

Step by step examples of implicit messaging within RSLogix 5000® are detailed in Appendix A.

Specification

The following table describes how the MW100 conforms to the EIP specification. Note that when interfacing to the MW100 on an EIP network no more than 10 connections can be active at any given time.

MW 100 Ethernet/IP Model Specification

Spec.	Description
Implementation	Level 2 (Message Server + I/O Server)
Connection	Max. 10
Protocol	EIP / PCCC, EIP / native
Messaging	Explicit (UCMM, Class 3) + I/O (Class 1)
Object	Assembly, PCCC, Data Table
Data Exchange	Max. 300 Ch (as integer or float data)
I / O	AI / AO, DI / DO (Max. 60 Ch)
Sampling	100 ms - 60 s
Recording	Max. 360 Ch (60 I/O + 300 Computation)

Summary

The MW100 with EIP support can easily communicate via Explicit or I/O messaging to a variety of PLCs. The MW100 requires the PLC to initiate all communications. Now that the MW100 can communicate with EIP based PLCs, the full capabilities of the DAQMaster MW100 can easily be added to a controller network.

A PLC can use the MW100 as remote inputs and outputs within its control logic.

A PLC can write its inputs and register values into the MW100 Communication Channels (C001 through C300) so the MW100 can record up to 300 PLC data points (Communication Channels must be placed into Computation Channels; only Computation Channels (A001-A300) and I/O Channels (001-060) can be recorded on an MW100).

Full MW100 network services are available including: real-time web-pages for monitoring data values, FTP of data files, e-mail, as well as custom web-pages (layout the data with graphics and save on purchasing a standalone HMI).

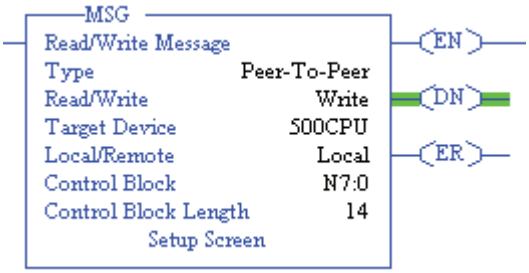
Appendix A – Detailed Explicit and I/O Messaging using RSLogix®

The majority of devices that the MW100 will be connected to using EIP will be Allen-Bradley PLCs. RSLogix 5®, RSLogix 500® or RSLogix 5000® are the programming packages used to configure and program everything from the legacy PLC 5® through the latest ControlLogix® CPU.

Explicit Messaging with RSLogix 500®

The following assumes basic familiarity with RSLogix 500® and RSLinx® and that both are installed and RSLogix 500® is able to communicate through RSLinx® to the designated PLC.

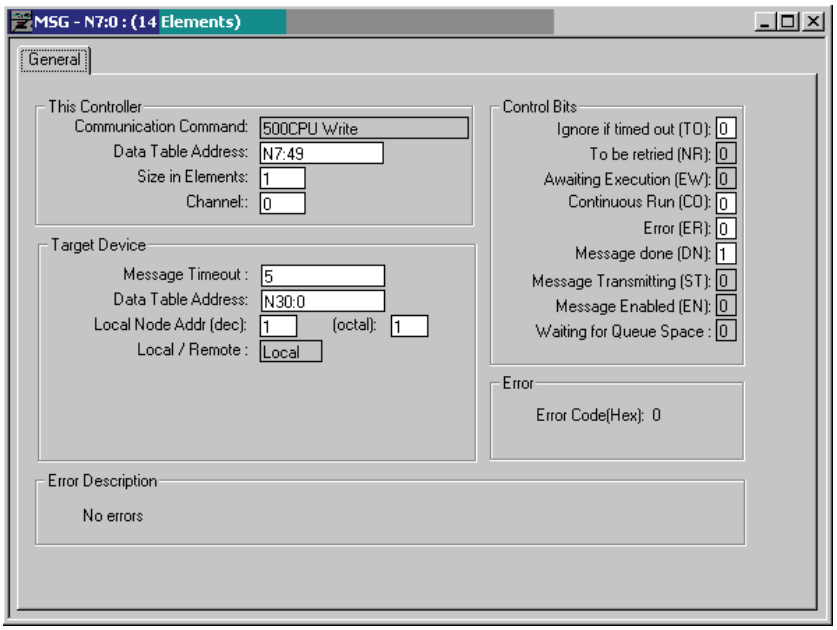
Messages are designated as MSG under the Input/Output tab of the instruction bar and may be inserted as the output of a rung of ladder logic. The MSG command can be used for reads or writes (the example below shows a write message). The target device should be set to 500CPU when talking to SLC 500® and PLC 5® for communicating to older PLC 5®. Control Block is used to set the location in memory for the MSG function to be stored and it should be different from the Data Table Address used on the Setup Screen (what data should be written to the MW100).



RSLogix 500® Write Message

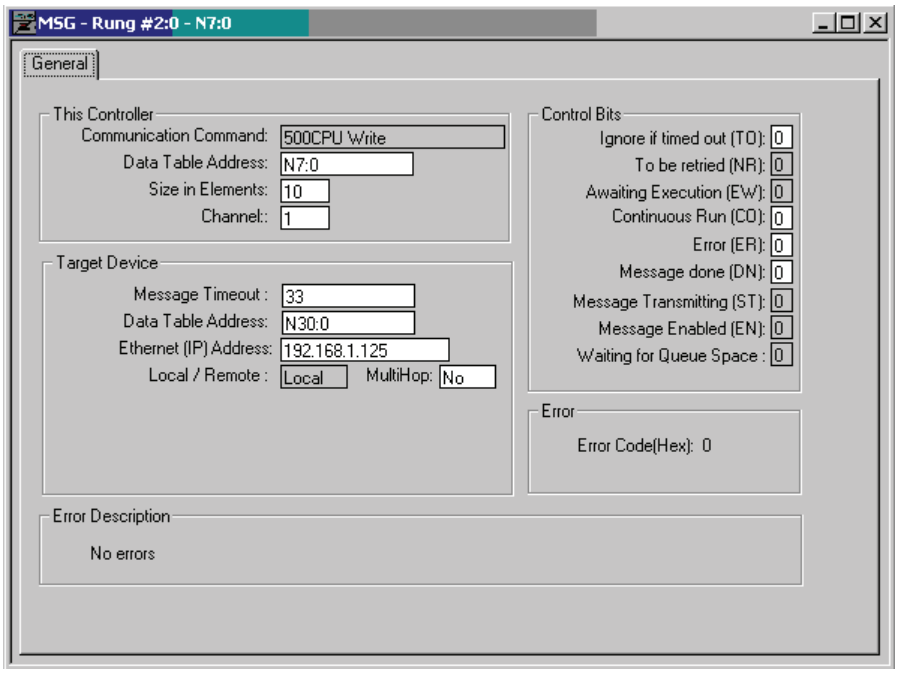
Once the Control Block is designated, the Setup Screen can be configured. The first item to fill in is the location of the data that is to be written from the PLC to the MW100, designated as the Data Table Address. In this case N7:49 is chosen with an element size of 1 (one byte of data - in order to read or write large amounts of data in a single message, increase the elements size to the appropriate value). Channel 0 designates what port to use on the PLC (in this case the serial port for DF1 communications – later routed via a DigiOne IAP (DF1 to EIP gateway)).

The next step is to configure where the message will be written. In this case a *Message Timeout* of 5 seconds is used and Communication Channel C001 is being written to as an integer using the syntax N30:0 for *Data Table Address*. In this case *Local Node Addr* is set to 1 so that the gateway device knows to route all commands issued to Node 1 to the IP address of a specific MW100. If multiple MW100s are on a network then using different Node Addresses within the message commands can be used in conjunction with a gateway to route messages to specific MW100s (e.g., Node 1 to MW100 A, Node 2 to MW100 B, etc…).



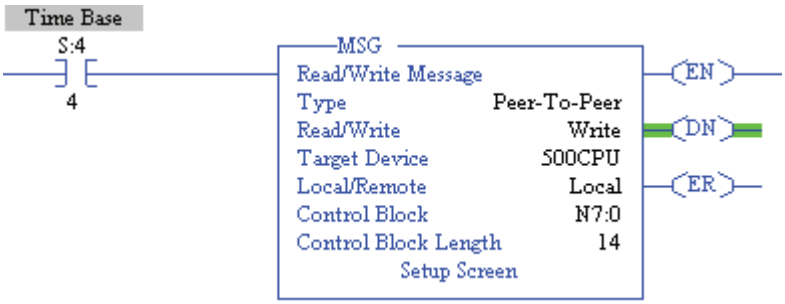
Write Message Setup Screen as configured for PLCs that support DF1

When using RSLogix 500® with controllers such as the MicroLogix® series that have on board Ethernet support, the Setup Screen looks slightly different instead of a *Node Address*, direct input of the MW100 IP address is allowed (no gateway or DF1 to EIP routing is required in this case).



Write Message as configured in a MicroLogix® or SLC 505® with EIP support

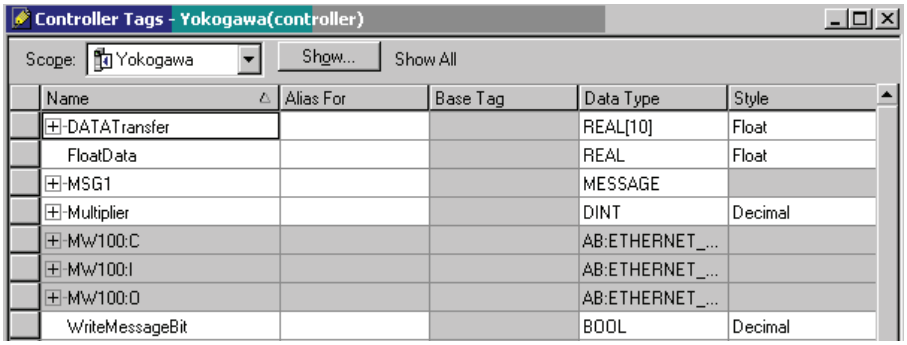
An explicit message should be triggered on/off by some sort of logic; the following image represents using the seconds bit of the PLC's clock to activate the message.



Time Based Message Write

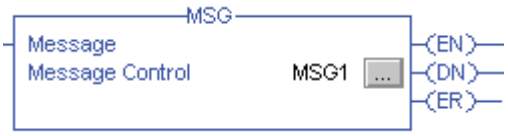
Explicit Messaging with RSLogix 5000®

Explicit Messaging within RSLogix 5000® is similar to messaging in RSLogix 500® but there are a few differences; the first is everything is simplified if the tags are predefined. From the Controller Organizer (tree on left) pick Controller Tags and create a tag of Data Type MESSAGE (in this example tag MSG1). Also create a tag that will hold the PLC data that will be written to the MW100 (in this example tag DATATransfer which is a block of 10 floating point numbers). A Boolean bit to activate the message was also created as the tag WriteMessageBit.



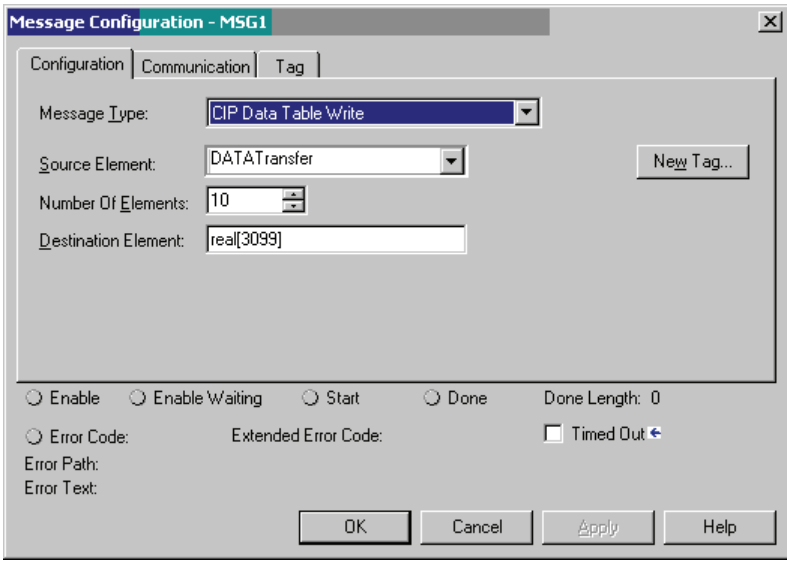
RSLogix 5000® Controller Tags Screen

The next step is to insert the message block from the Language Element Toolbar designated as MSG under the Input/Output tab. The MSG block can be inserted as the output of a rung. A controller tag of data type Message should be assigned to the MSG block, in this case tag MSG1.



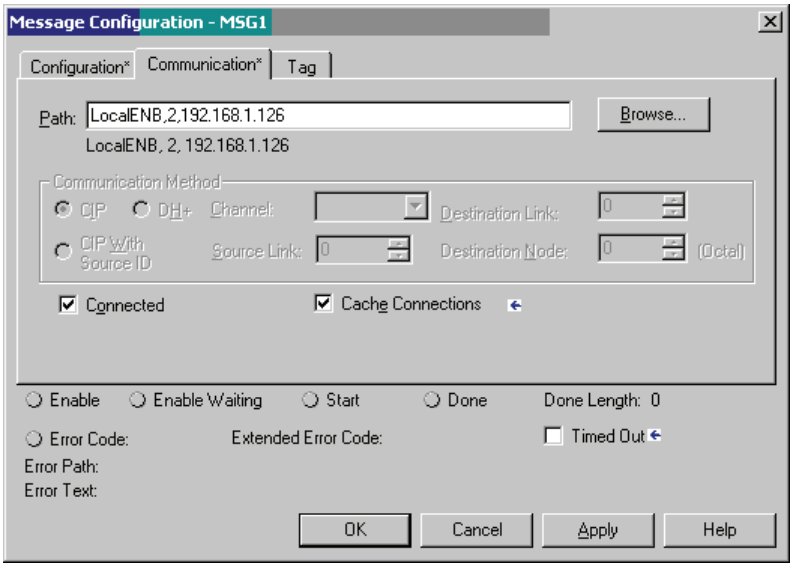
MSG block using tag MSG1

The next step is to configure the MSG block ([…] button). In this case the message block is configured to write data from the PLC to the MW100 so *Message Type* is set to CIP Data Table Write. *Source Element* is set to DATATransfer (tag within PLC) and the *Number of Elements* is set to 10 (number of bytes of data - in order to read or write large amounts of data in a single message, increase the Number of Elements to the appropriate value). The *Destination Element* is set to real[3099] which corresponds to MW100 Communication Channel C100.

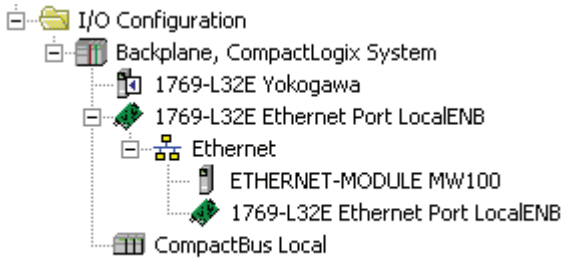


Message Configuration Tab

Next configure the Communication Tab by entering the *Path* to the MW100. The *Path* can be designated by the name of the Ethernet port on the PLC (in this case LocalENB – see I/O Configuration below) followed by a comma, with 2 (depth of communications) followed by a comma and the IP address of the MW100 (e.g., 192.168.1.126). Check *Connected* and *Cache Connections* to speed up communications to the MW100.

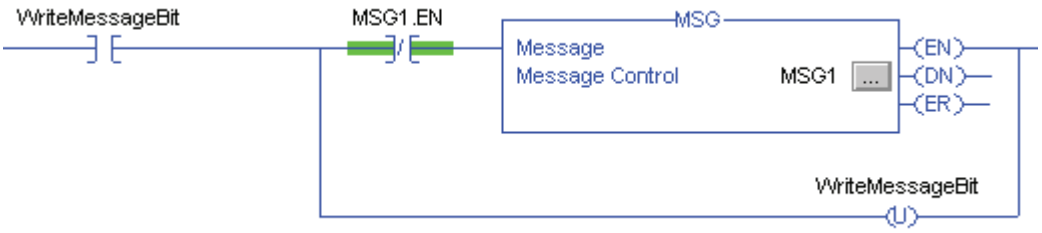


If the path to the MW100 is already configured in RSLinx® then RSLogix® will automatically replace the explicit path (e.g., LocalENB,2,192.168.1.126) with the named path (e.g., MW100 as seen below beside attached ETHERNET-MODULE). If the MW100 has not been configured within RSLinx® then ETHERNET-MODULE MW100 would not be present in the tree below and the explicit path on the Communication Tab will not be resolved and replaced with MW100.



I/O Configuration within Controller Organizer tree

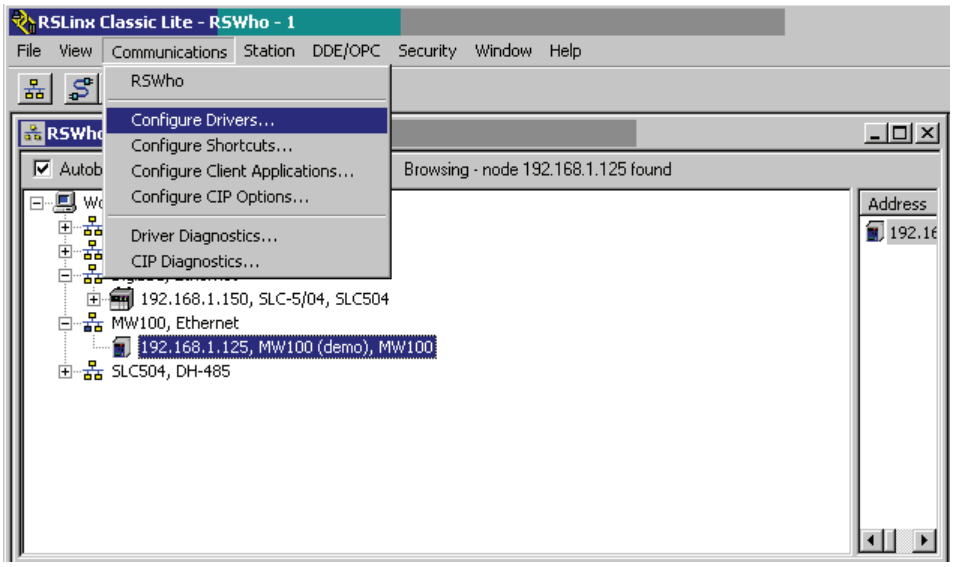
The last thing to do is to place some activation logic around the message to tell it when to write. In this case, when the contact WriteMessageBit is toggled on the MSG block activates and writes to the MW100; the WriteMessageBit is simultaneously toggled off with the output WriteMessageBit unlatch coil.



Contact Based MSG Logic in RSLogix 5000®

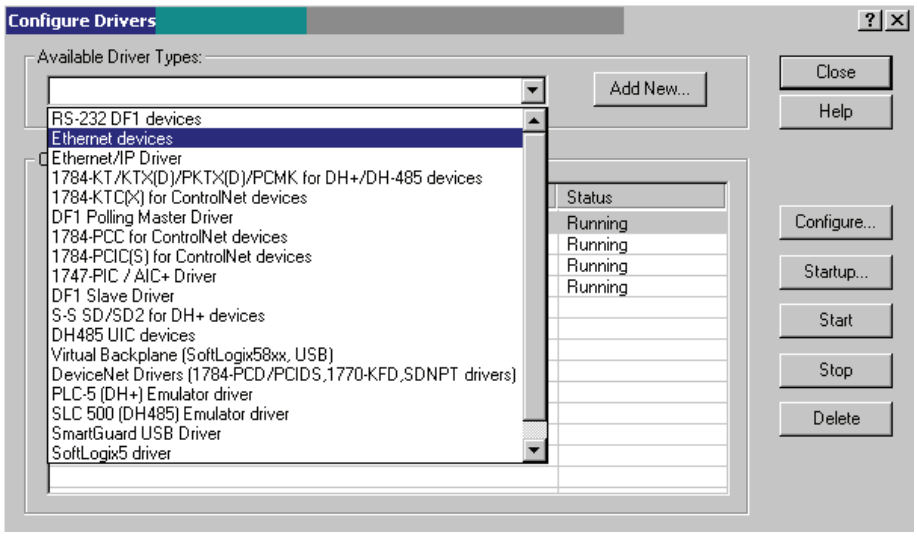
I/O Messaging with RSLogix 5000®

The first step in configuring an MW100 to communicate via I/O Messaging is to define a connection within RSLinx®. From the top menu under Communications, pick Configure Drivers.



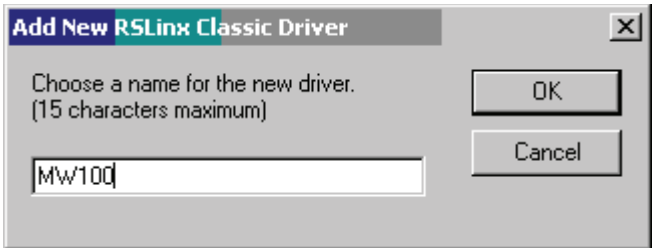
Configure Driver within RSLinx®

The next step is to select Ethernet devices (not Ethernet/IP Driver) to support the MW100 and then pick Add New…



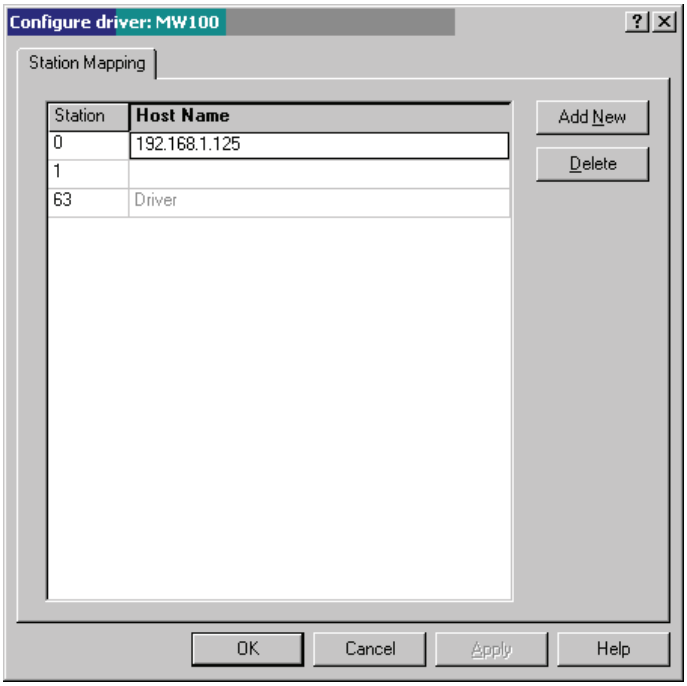
Ethernet devices driver for MW100

When prompted, name the driver – in this case MW100 was used but the name can be changed to suit different naming conventions.



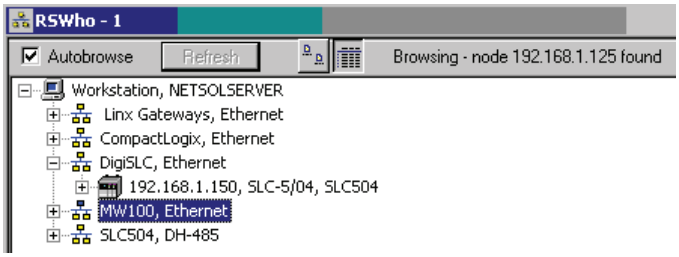
Path name for Ethernet Device

After the driver is named, enter the IP address of the MW100 and click OK to continue.



Configuring IP Address of MW100 within RSLinx®

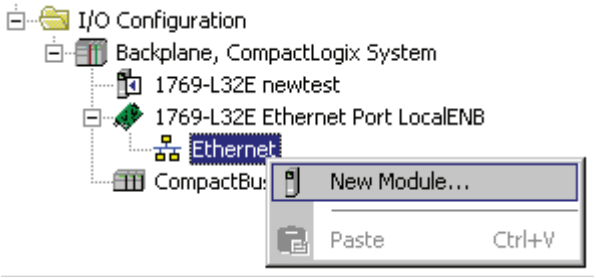
When properly configured there should be a new listing in RSLinx® for MW100. Note that when browsing the connection, RSLinx® indicates the node is found.



RSLinx® with MW100 added

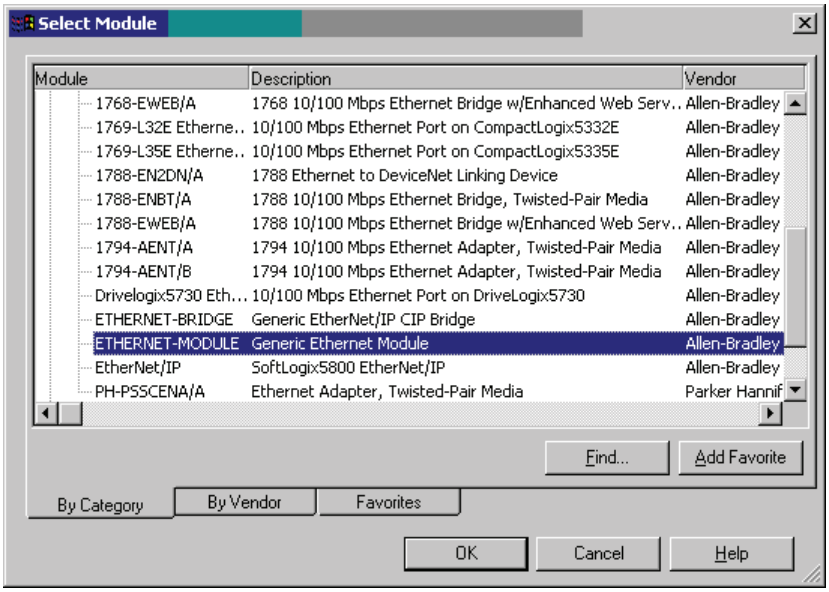
Note, EDS (Electronic Datasheet) and ICO files are available for integration purposes.

Open RSLogix 5000® and select the PLC that is going to communicate with the MW100. Right click on Ethernet and select New Module...



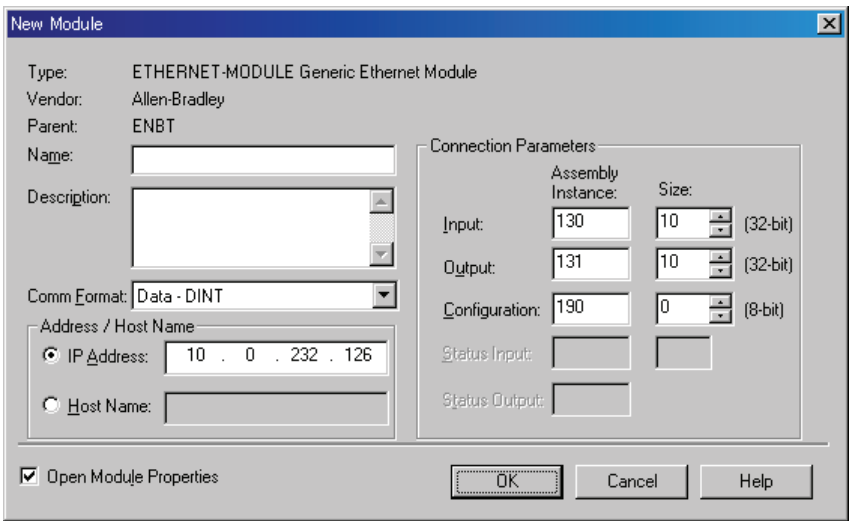
Adding a New Module to an RSLogix 5000® Project

Expand the Communications listing by clicking on the + sign and then scroll down and select ETHERNET-MODULE and click OK.



Selecting Generic Ethernet Module for MW100 Communications

A definition screen should now appear for the ETHERNET-MODULE. In the *Name* field – type MW100 (or the desired connection name). *Comm Format* can be left at Data – DINT and *IP Address* should be set to the IP address of the MW100. *Connection Parameters* are where the inputs and outputs are defined. In the *Assembly Instance* table below there are Instance IDs that correspond to channels within the MW100. All Instance IDs of Kind Producer can be assigned to *Input* (e.g., Instance ID 130 would point the Input at Communication Channel C001). All Instance IDs of Kind Consumer can be assigned to *Output* (e.g., Instance ID 131 would point the Output at Communication Channel C101). Size refers to how many channels are available per Instance ID. In the *Assembly Instance* table, all Instance IDs can have *Size* 100 except for MW100 Channels 001-060 that have a maximum size of 60. A smaller Size can be used if fewer channels are needed (e.g., below only 10 channels per Instance ID are configured). *Configuration* can be set to Instance 190 with Size 0. In the case that no Outputs are used, Output Instance can be set to 191, Size 0 for heartbeat purposes (allows MW100 to stop broadcasting for data if heartbeat goes away).



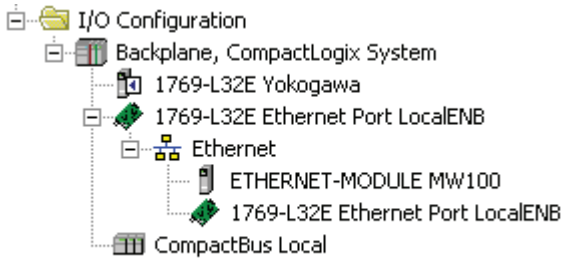
Configuring an MW100 as a Generic Ethernet Module

Assembly instances for I/O messaging

Channels in Assembly Object

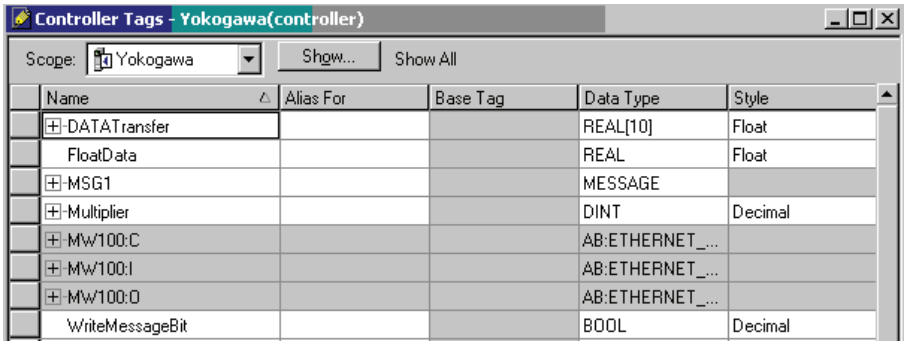
Ch.	Kind	Instance ID	Size	Type
001 - 060	Producer	110	4 x 60	dint
A001 - A100	Producer	120	4 x 100	dint
A101 - A200		121	4 x 100	
A201 - A300		122	4 x 100	
C001 - C100	Producer / Consumer	130	4 x 100	dint
C101 - C200		131	4 x 100	
C201 - C300		132	4 x 100	
	Configuration	190	0	
	Consumer	191	0	

Now that the MW100 is added, it should appear in RSLogix 5000® as a connection in the Controller Organizer.



I/O Configuration within Controller Organizer tree – ETHERNET-MODULE MW100

Browsing Controller Tags will now show MW100:I and MW100:O as tags that can be used within controller logic. Clicking on the + sign will expand the selection to show all the points up to the Size specified when defining the input and outputs on the module (e.g., Size 10 = 10 Channels/Tags).

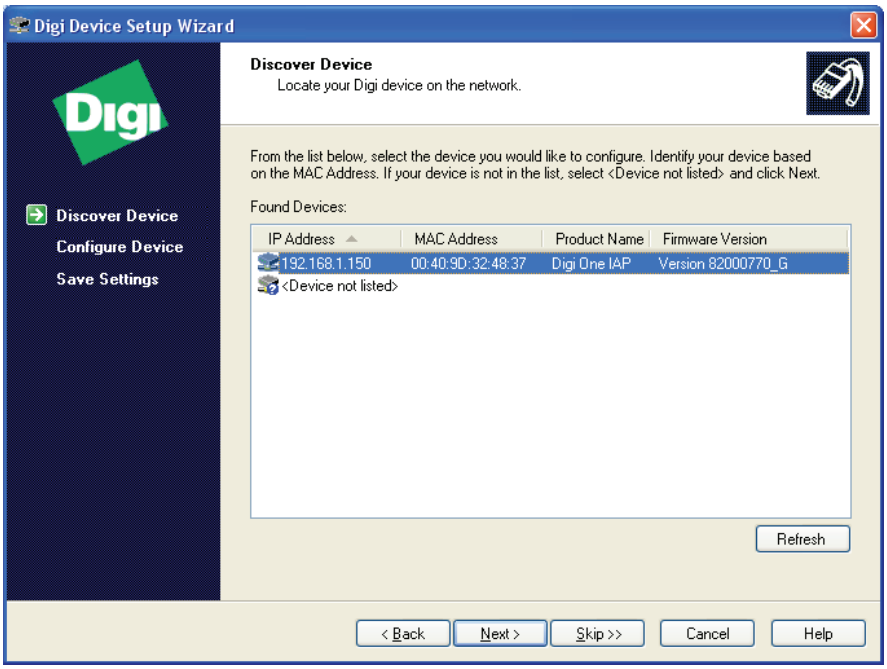


MW100 Channels now available as tags for controller logic

Appendix B – Detailed Configuration of DigiOne IAP Serial Gateway

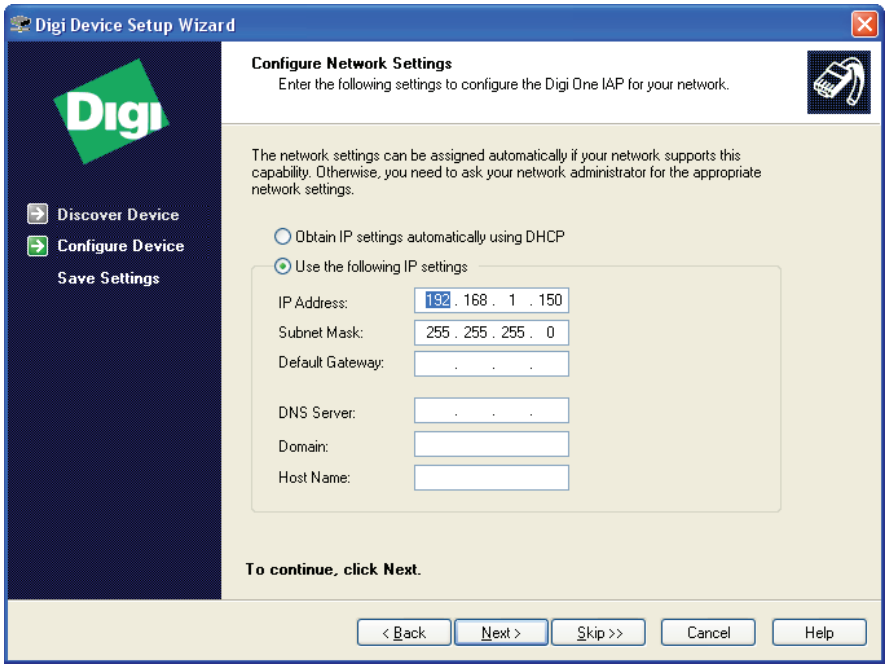
For PLCs that support serial communications via DF1 protocol, there are various gateways that can be used to intercept serial communications and translate to EIP. One such device is the DigiOne IAP®. The IAP has two serial ports and a single Ethernet port. Port 2 on the IAP is a 9 pin d-sub connector that can be connected to the 9 pin d-sub connector on PLC CPUs like the SLC 504® (and others). The IAP comes with a serial cable that easily connects the IAP to the SLC 504®. A standard Ethernet patch cable can connect the IAP to an Ethernet network. This example will show how to configure an IAP bridge communication between RSLinx®/RSLogix® and an MW100 with a SLC 504®.

Connect the IAP to the serial port on the front of the SLC 504® via the included serial cable. Connect an appropriate DC power supply to the terminals of the IAP and power the IAP up. Connect an Ethernet patch cable to the IAP and attach it to a network. The IAP comes with a CD that includes a setup utility. When the CD boots up, assuming auto-run is enabled, follow the instructions on the first page then click next and the setup utility will scan the network for IAPs. For a new IAP it will not have an IP address, but it should be easy to identify as the Product Name will show DigiOne IAP. Select the IAP and click Next.



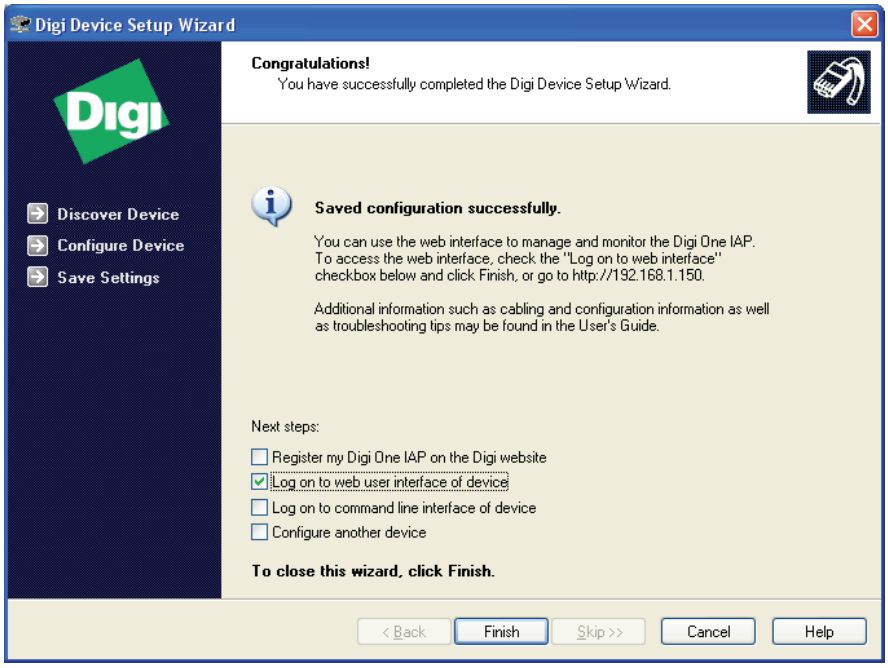
Auto discovery of IAP on network with DigiOne Setup Utility

Enter the IP address and subnet mask that is desired.

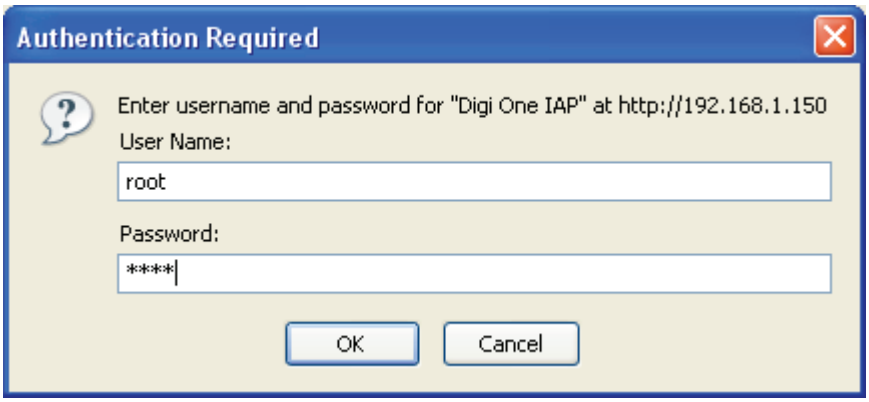


Configuring IP Address of DigiOne IAP

After configuring the network settings choose Skip and Next on the following two screens and the configuration should be saved to the IAP. The web interface has a wizard that can be used to configure the IAP for industrial networks. On the final screen of the setup utility select Log On to the web user interface of device and click Finish.

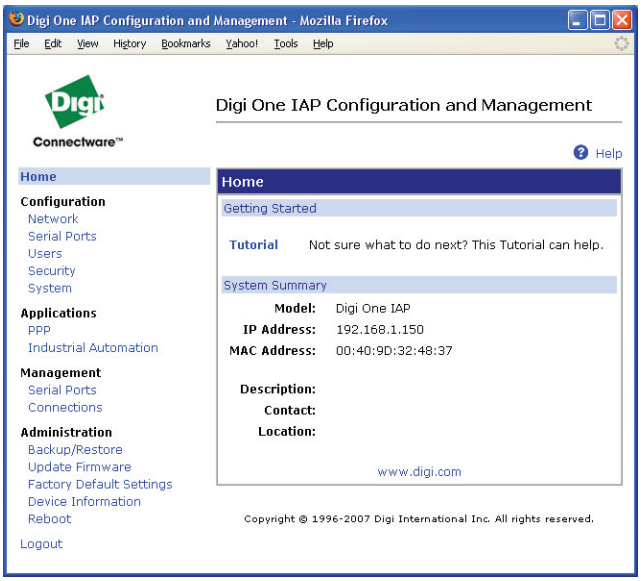


The default web browser should pop up with a prompt for a user name and password (if it does not automatically launch the web browser, then open a web browser and browse the IP address of the IAP). The default User Name for the web interface is *root* and the default Password is *dbps*.



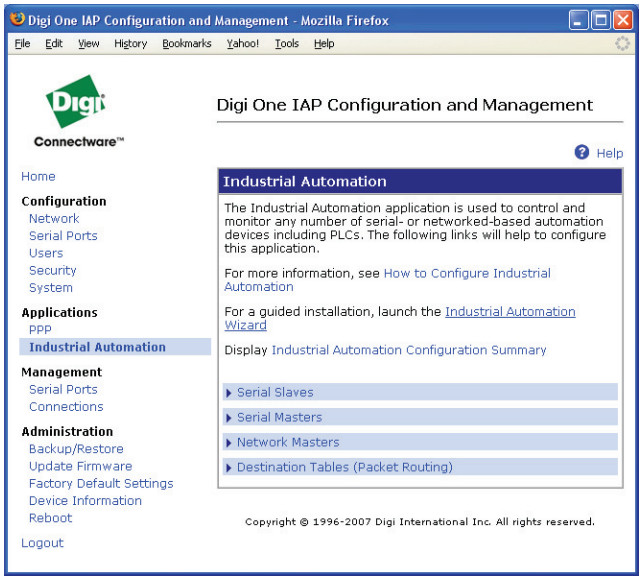
IAP Security Screen

After logging, in the main page of the DigiOne IAP web configuration should appear. Select Industrial Automation under Applications to continue.



Home page of IAP configuration

Select Industrial Automation Wizard link in the center of the screen to configure the IAP for an industrial network.



Industrial Automation page

Enter a table name for this configuration and then click Next.

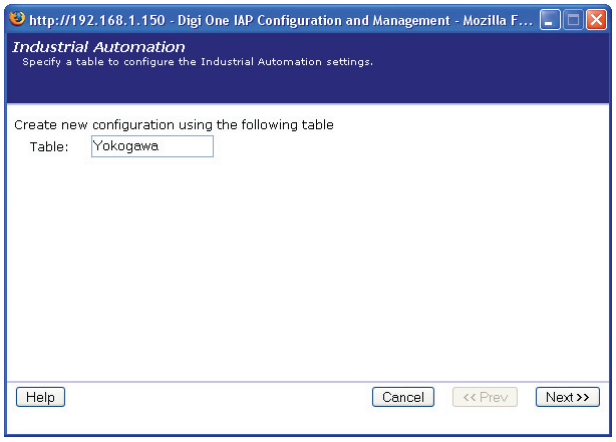
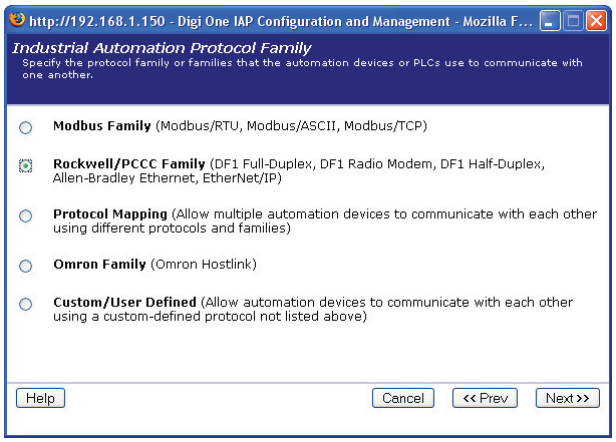


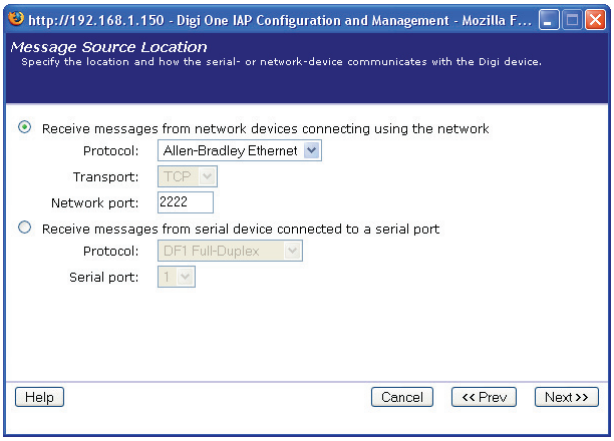
Table Name for Industrial Automation Setup

Select Rockwell/PCCC family and then click Next twice.

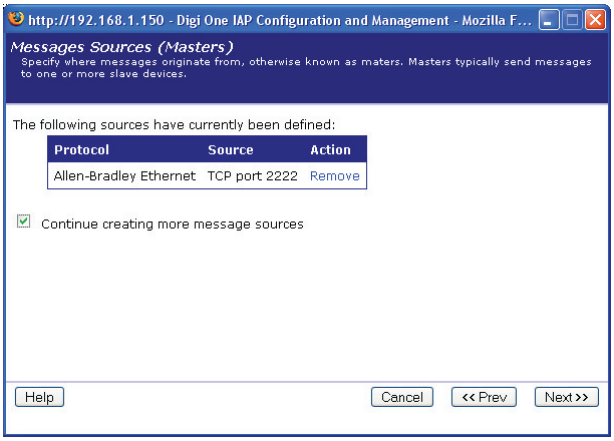


Choosing Industrial Protocol

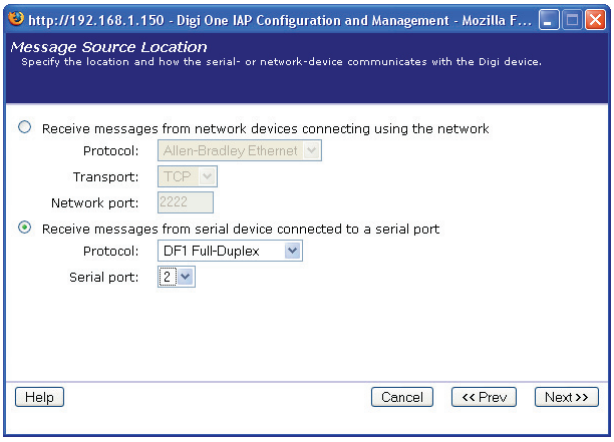
The first source that will be setup is the interface for RSLinx® choose Allen-Bradley Ethernet and click Next.



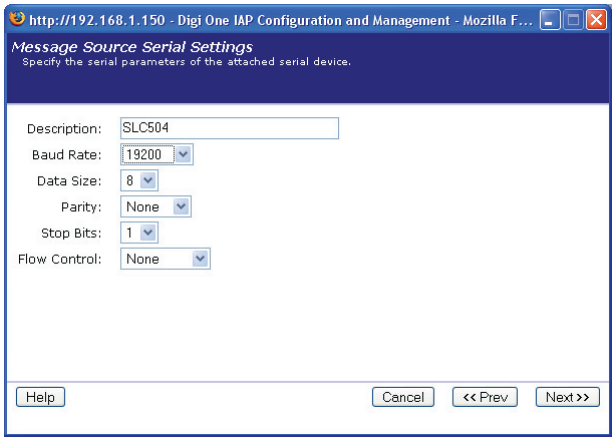
Click Next until the following screen shows up and check the Continue creating more message sources box and then click Next.



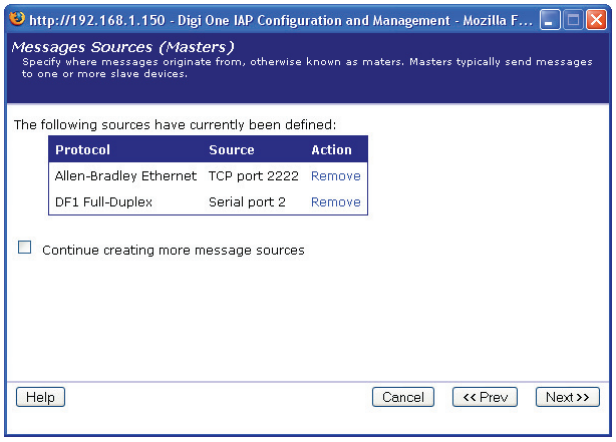
Select Receive messages from serial device connected to a serial port and choose DF1 Full-Duplex for the Protocol and 2 for the Serial port, click Next to continue.



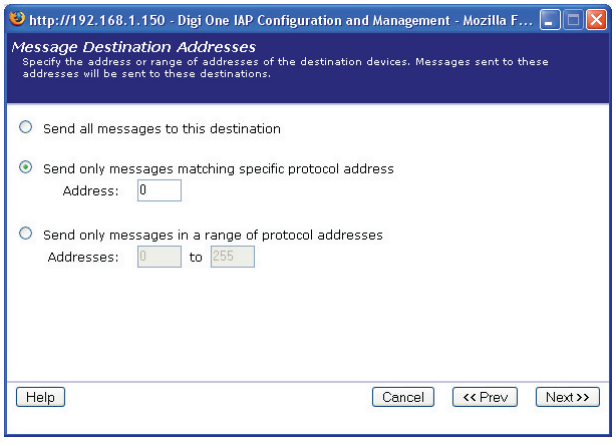
Give the source a Description and configure the serial options to match the configuration of the PLC, then click Next.



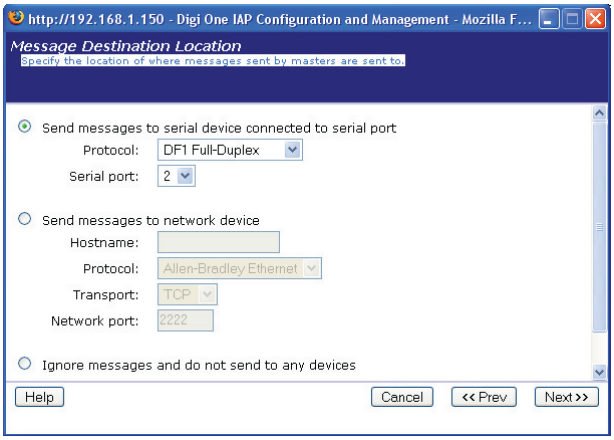
Click Next until the following screen shows up and then uncheck the Continue creating more message sources box and click Next.



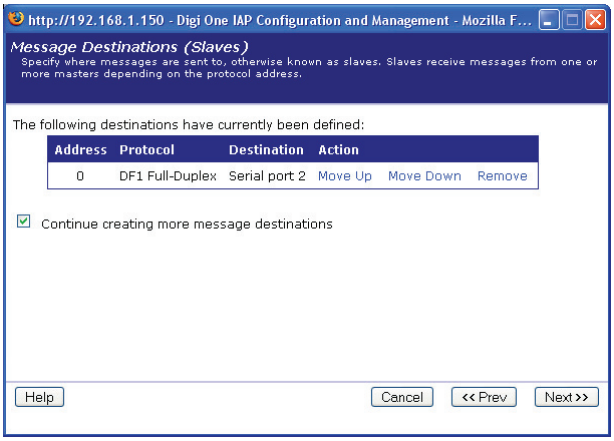
When the IAP receives communications, it needs to know where to route the information. To send data to the SLC504® set protocol address to 0.



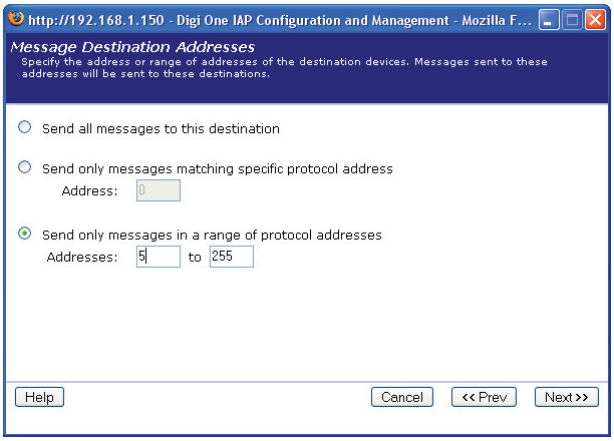
Address 0 communications need to be retransmitted over the serial port connected to the SLC504®. Set Protocol to DF1 Full-Duplex and Serial Port to 2.



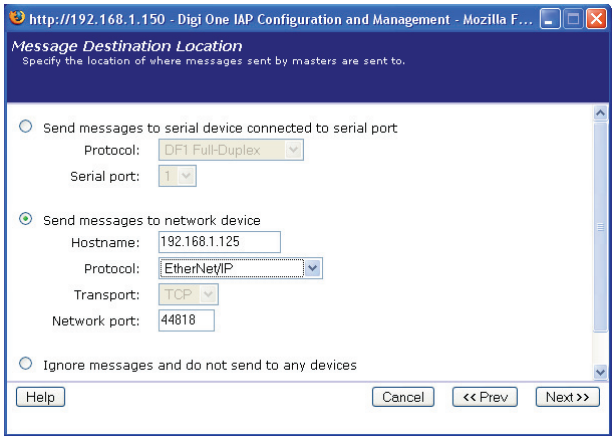
Click Next to accept defaults until returned to this screen and then check Continue creating more message destinations and Next.



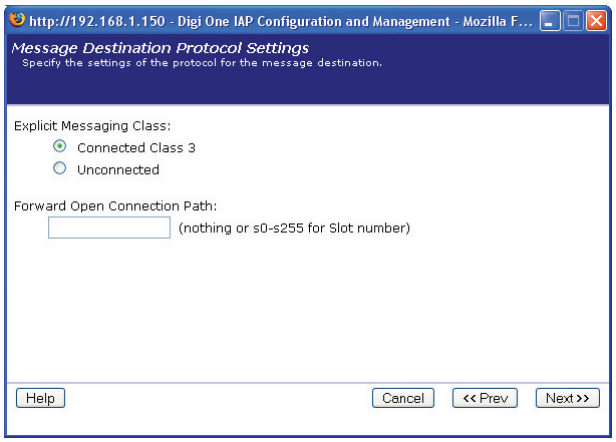
Now it is time to route communications to the MW100. In this case, all read and write commands issued from the SLC504® in this example are sent to Node 5 (it could be set to read or write to any other address). If the SLC504® is going to write to devices with different addresses, then confine the address to just the address of the specific MW100. In this example the IAP will route any message with an address of 5 to 255 of the MW100. Click Next to continue.



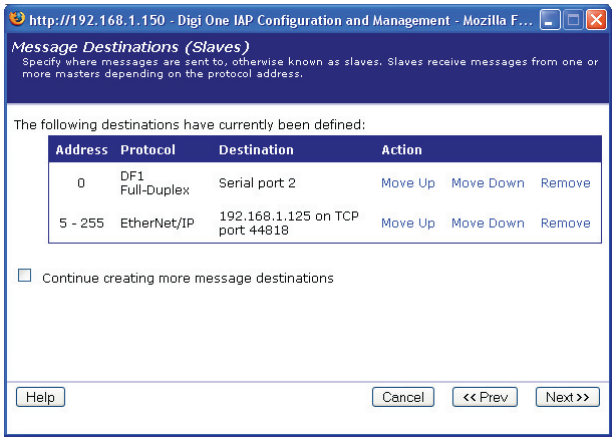
The next step is to tell the IAP where the MW100 is located and how to talk to it. Select Send messages to network device at Hostname – IP Address of MW100. Select EtherNet/IP for the Protocol and then Next.



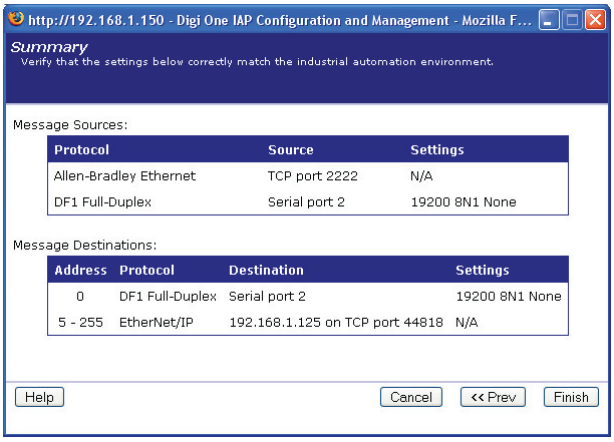
When the Message Destination Protocol Settings screen appears, ensure that *Forward Open Connection Path*: is left blank.



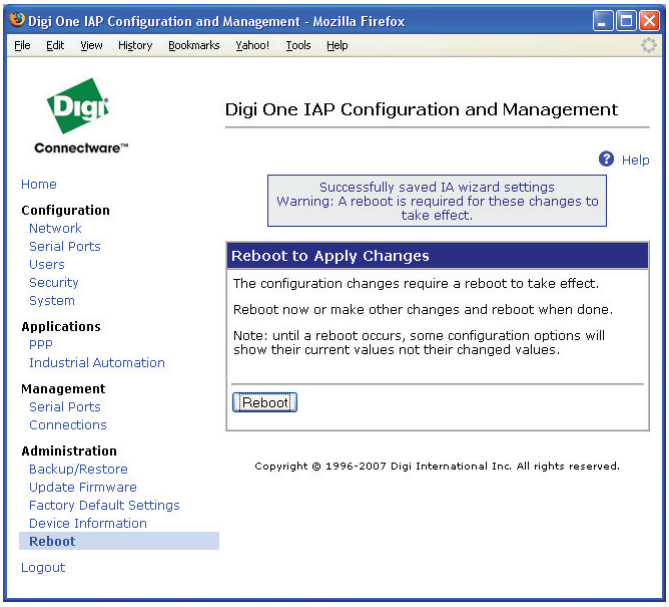
Click Next until the following screen shows up and then uncheck Continue creating more message destinations. Click Next to continue.



If all the settings match on the Summary page, click Finish to save the configuration in the IAP.



The IAP will then ask to be rebooted so all the settings can take effect. Once the IAP is rebooted, the DigiOne IAP and attached SLC 504 can now be added as an Ethernet Device (add driver) in RSLinx® (use the IP address of the IAP as the IP address for the Ethernet Device).



Note, when using RSLogix 500® with the IAP, it is necessary for the PLC to have its key turned to program mode to download the existing program from the PLC to the PC.

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